Information Bulletin – Design Objectives For Solid Manure Storage Facilities

Manitoba Sustainable Development

The Livestock Manure and Mortalities Management Regulation (Manitoba Regulation 42/98) regulates livestock solid manure storage facilities. The regulation is available at http://web2.gov.mb.ca/laws/regs/current/_pdf-regs.php?reg=42/98.

Under the regulation, permits are required to construct, expand or modify storage facilities. The designs of facilities are undertaken by engineering consultants on behalf of the facility owners. These design objectives outline considerations for the design of the facilities based on Manitoba experience. The required considerations must be incorporated into the design to address matters of environmental significance. The optional considerations address the efficacy of the design and its serviceability as well as the environmental performance of the facility.

These design objectives provide a practical approach to facility design. Manitoba Sustainable Development (MSD) is responsible for environmental protection, and engineering consultants are responsible for the engineering performance of the facility.

Where design objectives are indicated as 'must' or 'required', other approaches are major deviations from the design objectives and require approval by MSD. The person proposing the approaches will provide supporting information and explanation to support the proposal to MSD. Where design objectives are indicated as 'should', 'typically' or 'normally', other approaches may be used if in the professional judgment of the design engineer they will accomplish the desired objective.

These design objectives will be updated as needed to reflect any future changes in the regulation or to provide clarification. Engineering consultants and facility owners/operators are encouraged to contact the Environmental Approvals Branch of Manitoba Sustainable Development directly if they have questions or concerns regarding these design objectives.

Scope

These guidelines:

- Address storage of solid manure – manure that contains more than 25% solid matter and does not flow when piled; and
- Do not address storage of liquid and semi-solid manure (for which separate guidelines are available at: http://www.gov.mb.ca/sd/envprograms/livestock/pdf/liquid_manure_storage_facilities_design_guidelines.pdf).

Manure storage facilities store manure until it can be applied to agricultural land. A manure storage facility (MSF) must be provided when manure will be stored for more than 30 days at the same site, unless it is in field storage or at a temporary composting site.

- Field storage is solid manure stored in the open air on an agricultural field that is not in a manure storage facility; and
- Composting is a designed and managed system to facilitate the aerobic decomposition of organic matter by biological action.

A manure storage facility includes any permanent equipment or structures that moves manure to the manure storage facility. It does not include vehicles or other mobile equipment to transport or spread manure, gutters or pits that store manure for less than 30 days, or convey manure to a manure storage facility. For clarity, field storage and temporary composting sites are not manure storage facilities.

Characteristics of Solid Manure

Solid manure contains more than 25% solid matter and does not flow when piled. Typically, this form of manure is produced by pullet operations without bedding, layer operations without bedding where production systems will adequately dry the manure, broiler operations with bedding, biotech shelters, loose housing or straw pack dairy operations, and beef and sheep operations. Therefore, solid manure may or may not include litter or bedding material such as straw, wood chips or flax chives.

Design Objectives

These guidelines apply to manure storage facilities being constructed, expanded or modified.

1. **General** The facility design must be compatible with the municipal approval pertinent to the facility. For new or expanding operations, one of four possible municipal approval documents must be provided with the permit application package:
   - **i.** For operations which require no municipal approval, a letter or a copy of a letter from the Municipality indicating that no approval is required; or
   - **ii.** For operations below the municipality's threshold for a conditional use approval, a copy of the development permit; or
   - **iii.** For operations at or above the municipality's threshold for a conditional use approval, a copy of the conditional use approval; or
   - **iv.** Where the municipality chooses to provide its development permit or conditional use approval after the manure storage facility permit is issued, a letter from the municipality indicating this choice.

The purpose of this requirement is to ensure that the municipality is aware of the owner's intention to build or expand a manure storage facility, and that the municipality and the owner know the type and timing of any needed municipal approval. This avoids unexpected requirements and delays later in the planning and construction process.

Existing operations not intending to expand the size of the operation beyond the current number of animal units are not required to provide any of the above municipal approval documents when proposing to construct a new or expand an existing manure storage facility. However, it is recommended that the owner advise the municipality of the intent to construct or expand a manure storage facility. This provides an opportunity for the owner and the municipality to address any potential concerns and avoid unexpected delays following issuance of the permit.

2. Location Manure storage facilities are located on land controlled by the facility owner and/or operator. They are typically located near the manure source or spread lands.

a) Setbacks: Manure storage facilities must be located a minimum of 100 metres away from a surface watercourse, sinkhole, spring, well and the boundaries of agricultural operations, unless a variance is obtained. The setback distances are to be measured from the closest exterior part of the facility to the feature of concern.

b) Surface Runoff: The siting of manure storage facilities in locations receiving significant amounts of runoff water is discouraged unless adequate provisions are made to divert storm water and snowmelt around the facilities and prevent storm water and snowmelt from coming into contact with stored manure. Areas which are frequently inundated shall be avoided. If the facility is to be situated in an area requiring a designated flood protection level (Red River valley or other flood-prone locations), the level specified in the designated flood area permit must be noted and the lowest floor elevation for the manure storage facility must not be below this level or must be protected by dykes appropriately.

c) Groundwater Pollution: Proximity of manure storage facilities to water supplies and other facilities subject to contamination and location in areas of porous soils and fissured rock formations must be critically evaluated to avoid creation of health hazards or other undesirable conditions. Where containment is intended to be provided with a soil liner, the minimum containment requirement is a one metre soil thickness with a hydraulic conductivity of 1 $x10^{-6}$ cm/second or less. Where this requirement cannot be met, artificial liners or concrete containment must be used. The design of the facility must provide a rationale for the final selection of the type of storage facility. The regulation requires that manure storage facilities be designed, constructed and operated so that pollution to surface water, groundwater or soil does not occur. In the design of a facility, sufficient engineering investigation is required to ensure that groundwater presence is identified and that pollution will not occur. Typically, groundwater presence is verified by checking with at least three boreholes to a depth of 2 metres below the ground surface at a site. The depth of the boreholes must be sufficient to

demonstrate that at least one metre of suitable clay (discussed below in item 6) is present between the bottom of the facility's floor and groundwater. A 2 metre depth normally provides a satisfactory indication of conditions below the anticipated floor elevation of the facility.

3. **Sizing** Provision shall be made for storage based on holding manure for the design retention period. Note – winter spreading is not allowed, normally extending from November 10 to April 10 of the following year. Additional storage volume is normally provided to accommodate unfavorable spreading conditions in the spring and/or fall. The regulation prohibits storage over 750 days. Assumptions made in the design for the storage period must be clearly outlined.

4. **Moisture Control During Storage** Solid manure storage facilities are designed to prevent additional water such as runoff following rainfall or snowmelt from significantly increasing the moisture content of the stored manure. Solid manure storage facilities for poultry operations are typically covered to prevent the entry of additional water into the manure.

5. **Safety Considerations** Safety features for operators and the general public should be noted in the design. This may include signage, fencing around facilities that may be accessed by the public, and safe walkways with appropriate handrails for operators performing normal daily activities, as necessary.

6. **Clay Lined Solid Manure Storage Facilities** Facilities may be designed with a 1 metre thick layer of in-situ clay where soil at the site can be shown to achieve a hydraulic conductivity of 1×10^{-6} cm/second or less. Alternatively, a 1 metre thick clay liner can be constructed utilizing soil material excavated from the site or from a borrow pit capable of achieving a hydraulic conductivity of 1×10^{-6} cm/second or less, when compacted. Clay that meets this requirement is considered to be suitable clay.

   Clay liners must have a minimum thickness of 1 metre perpendicular to any surface. The hydraulic conductivity and thickness will be verified by testing upon completion of the liner construction. Where storage facilities will be covered with a building, clay liner testing is done before the building is constructed over the liner. To protect the liner during removal of manure, a layer of sufficient granular material or concrete must be added over the clay liner.

   The amount of testing required for construction of a new facility is dependent on site conditions such as the size of the facility, the uniformity of soil conditions and the quality of construction. The requirement for testing and the amount of testing required for modification of an existing facility is dependent on the nature of the modification work and the extent to which it affects the integrity of the liner. Hydraulic conductivity testing is described in Manitoba Sustainable Development's Information Bulletin – Hydraulic Conductivity Testing for Manure Storage Facilities.

7. **Concrete Manure Storage Facilities** Where soil at the site or nearby is not suitable for containment, or where groundwater levels may be within 1 metre of the floor of the facility, containment can be provided with a concrete floor and retaining walls. The floor must be capable of supporting unloading equipment and reinforced with shrinkage steel to control cracking. Normally, shrinkage crack control is achieved with 10 M steel at 30 cm spacing in perpendicular directions, or by applying a design Z factor of less than 20 kN, or 17 kN for environmentally sensitive areas. A different method to control shrinkage cracking may be included in the design package with explanation.

8. **HDPE Lined Manure Storage Facility** Where soil at the site or nearby is not suitable for containment, or where groundwater levels may be within 1 metre of the floor of the facility, containment can be provided with a 60 mil high density polyethylene (HDPE) liner on the floor and containment dykes as an alternative to concrete containment. To protect the liner during removal of manure, a layer of sufficient granular material or concrete must be added over the HDPE liner. The liner installer must complete a report after the liner has been installed and tested, and the approval of the assigned Environment Officer must be received prior to the use of the facility. The installation report must include a location plan showing all panels of the liner, and, typically in tabular form, the dates of panel installation, a description of each panel including its size and origin, the names of persons seaming and testing each panel, a reference to the testing method, and a list of repairs, including type, location, reason, and repair technician. The installation report also includes a statement that the completed liner meets the permit requirements. The Environment Officer may inspect the liner during the construction process.

Drawings

Engineering drawings for manure storage facilities must be submitted with the application. All engineering drawings must be of a scale that is readable, including when printed. Design features noted above as requirements in these guidelines ("must" or "required") are required to be shown on the drawings. Construction notes may be included on the drawings, or appended on separate sheets. Construction notes must include information on construction supervision by the design engineer.

In particular, the drawings must show the location of the facility relative to surrounding buildings, natural features and property boundaries, sizing details, manure containment details and notes on how construction will be carried out and supervised.

Alterations

Alterations or amendments to the original design relevant to environmental significance (i.e., requirements from these guidelines) must be approved prior to incorporation into the construction and must be reflected in record drawings. For alterations related to the efficacy and serviceability of the facility, notification rather than approval is needed, and the alterations must be reflected in record drawings.